TECHNOLOGY OPTIONS TO LEVERAGE AEROSPACE POWER IN OPERATIONS OTHER THAN CONVENTIONAL WAR (OOTCW)

Recommendations from the 1999 Technology Leveraging for Aerospace Power (TLAP) in Operations Other Than Conventional War (OOTCW) Study are divided into the following topics and subtopics:

OVERARCHING RECOMMENDATIONS Non-Lethal Weapons Offensive/Defensive Information Warfare Defensive Information Warfare Technology Funding
INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) Enable Persistent ISR Develop and Integrate ISR with Dynamic Planning
DEVELOP A SPECTRUM OF TAILORED WEAPONS EFFECTS
MAINTAIN READINESS AND PRESENCE WITHIN OPTEMPO CONSTRAINTS

OVERARCHING RECOMMENDATIONS

For the Global Positioning System: GPS is critical to Operations Other Than Conventional War (OOTCW). As recommended by the SAB since 1993, the Air Force should improve its accuracy and survivability.

1. Implement proposed modifications to the Block II R and Block II F satellites, including both military and civil enhancements. The Air Force should collaborate with the DOT (Department of Transportation) to upgrade both the civil and military capabilities of the GPS. Begin this modernization process now.
2. Support upgrades to satellites, ground stations, and user equipment to achieve a basic accuracy of 1 meter, or better, without the aid of secondary accuracy enhancements, such as local differential GPS.

To successfully transition to an expeditionary Air Force (eAF) the Air Force should broaden its focus to encompass training, communications, deployment, weapons, and forward basing recommendations from the 1997 SAB Summer Study "Aerospace Expeditionary Forces" and this current (1999) Summer Study.

1. The planning, logistics, and training aspects unique to OOTCW need to be developed, fielded, and exercised throughout the Air Force.
2. The Air Force should review and act upon the recommendations of the 1997 SAB Summer Study, including:
   - Exercising with minimal notice and including logistics aspects and OOTCW-unique weapons
   - Establishing appropriate worldwide databases for deployment
   - Fielding rapid-planning tools
   - Re-negotiating diplomatic clearances and host nation support where possible
   - Establishing Regional Contingency Centers

<u>Non-Lethal Weapons</u>

The Air Force should develop a comprehensive vision and strategy that takes into full account all potential roles of non-lethal weapons, including "variable effect" and delivery from air and/or space.

Non-Lethal Weapons (continued)
Integration into the overall response continuum is essential. In integrating non-lethal means into its arsenal, the Air Force needs a strategic vision and strategy; including:

1. A doctrinal basis for the Air Force's strategic plans and vision
2. Plans to include the development of non-lethal weapons to be delivered from aerospace platforms
3. Educating Air Force leadership on non-lethal weapons/means, and
4. The Air Force taking its place with the other Services in the development and integration of joint Services (more Air Force involvement in the JNLWD). Specifically, the Air Force should:
   - Develop a comprehensive strategy that takes into full account all potential roles and uses of non-lethal weapons, including delivery of non-lethal effects from air and/or space for strategic and/or tactical purposes
   - Develop a vision that realizes the "variable lethality" concept• "Catch up" and cooperate with the other Services in the ability to effectively employ non-lethal capabilities
   - Develop a comprehensive acquisition strategy to develop, test, and procure non-lethal weapons for air operations.

Ensure the RRP (Rapid Response Program) remains viable to define, develop, and deploy urgent, time-sensitive systems identified by the commanders-in-chief (CINCs) as critical to combat operations, including OOTCW.

Offensive/Defensive Information Warfare
Ensure that the development of strategies, concepts, and techniques for offensive and defensive information warfare are closely coupled for maximum effectiveness.

The Air Force should encourage cross fertilization of ideas, strategies, and techniques from both offensive and defensive points of view. The timely recognition of a sequence of narrow windows of opportunity to improve the effectiveness of information systems, and their concurrent exploitation in Offensive Information Operations (IO) and protection of our systems through Defensive IO, mandate that the Defensive and Offensive IO communities be closely coupled, sharing concept definition, science and technology investments, and the development of strategies and techniques.

Defensive Information Warfare
The critical requirement for information superiority suggests increased emphasis on defensive information warfare, including assessment of detected threats and development of responses.

The Air Force needs to develop tools and techniques that will allow timely assessment of the effect of attacks on our information systems, both in terms of identifying specific system vulnerabilities and in terms of the information and systems that may have been compromised.

The Air Force should develop the spectrum of responses as well as a set of guidelines for matching the type of threat with the appropriate response so as not to compromise our information assets. Attack assessment and response selection (for example, whether to contain, deny, or destroy the attacker) need an infusion of ideas and concepts. The Air Force should pay particular attention to the attack from within—to assess its (potential) damage and develop effective strategies for its containment.

Technology Funding
Ensure that funding is available to laboratory managers to focus on promising technologies and revolutionary capabilities.

Technology Funding (continued)
Encourage industry-independent research and development managers to do the same. It is incumbent on the Air Force to ensure that the unique or more stressing requirements of OOTCW operations are considered carefully in the requirements, research, development, and acquisition process; rather than focusing on Major Theater War (MTW) and treating OOTCW operations as "lesser-included cases."

SAF/AQ must ensure the balance of resource allocations such that the S&T community:

1. Is responsive to the long-term operational capability requirements formally established by the warfighter;
2. Is responsive to short-fuse urgent breakthrough needs identified by operational and technical activities; and
3. Can conduct developments under the discretion of the Lab (AFRL) Directors to take into account both innovative technical concepts and anticipated future warfighter needs.

A system of incentives and exchanges is required to reduce the constraints on researchers who are doing long-term (revolutionary) work and to make a more systematic effort to educate consumers (the warfighters) about the possible operational concepts that might be enabled by technology breakthroughs.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)

Enable Persistent ISR
Expand ISR (Intelligence, Surveillance & Reconnaissance) capabilities for unmanned aerial vehicles (UAVs) to augment long-duration data collection.

Start with air surveillance on Global Hawk. Begin immediate development of a low-cost radar/IFF system for the Global Hawk UAV, based on the current technology base. Such a sensor and platform could provide augmentation of manned systems and provide I&W (information and warning) for air target situational awareness in situations such as no-fly zone enforcement. They would be self-deployable and immediately operable in theater.

In parallel, begin work on multi-intelligence (for example, SIGINT and measurement and signature intelligence) technologies suitable for deployment on UAVs.

Develop sensors and air-launched vehicles for ISR, targeting, and BDA (Battle Damage Assessment) of ground targets.

Develop a program to integrate newly developed low-cost sensors and air-launched and airdropped deployment vehicle technology for ISR, targeting, real-time BDA, and the delivery of both lethal and non-lethal systems.

1. UAVs (high-altitude and medium-altitude) with standardized payload interfaces
2. Small air vehicles (MALD--maneuverable air-launched decoys, MAVs--maneuverable air vehicles, and parafoils
3. Ultraprecision (< 1 m) delivery, robust navigation
4. Ultraminiature guidance systems
5. Ultraminiature low-power electronics
6. Microsensors (fuses, seekers, and MEMS--micro-electromechanical systems-- for guidance, chemical and biological, acoustic and seismic, RF, IR)
6. Modern communications (low-power, internetted, satellite) and C2
7. Robotics for end-game mobility.

Develop and Integrate ISR with Dynamic Planning

Implement a force management capability for the EAF (expeditionary Air Force) and for OOTCW that supports the EAF in the application of aerospace power to OOTCW and enables dynamic effects-based planning, execution, and assessment--including strike, airlift, and training.

Continue selective deployment of the TBMCS, but

1. Immediately begin preparation of an operational architecture to ensure that TBMCS meets the needs of the EAF in OOTCW. Include logistics, training, and lift aspects (AC2ISRC).
2. Assess the proper course of action for TBMCS according to this architecture (AF/XO and SAF/AQ).
3. Establish a new function equivalent to AF/XOR for architectures and concept of operations for integrated force management systems (AF/XO).
4. Develop C2ISR education within the Air Force and establish appropriate specialty codes (AF/DP).

Lead the development and deployment of an integrated ISR--Command and Control Information Management System--to meet the stringent timelines for tailorable and continuously updated information on demand for warfighters worldwide.

1. Develop the operational architecture, functional requirements, and an implementation roadmap (AC2ISRC).
2. Pursue Air Force-owned elements of the roadmap (SAF/AQ).
3. Lead a joint DoD-intelligence community initiative for development and deployment (Air Force).
4. Use a demonstration to drive development of the following relevant technologies (SAF/AQ):
   (a) Representation of information,
   (b) Information fusion,
   (c) Dynamic allocation of sensing assets,
   (d) Interaction with the user, and
   (e) Performance assessment.

Implement robust aerospace expeditionary force (AEF) communications for rapidly emerging crises, thus enabling immediate combat power for OOTCW crisis response anywhere. Multilevel secure communications architecture and requirements for OOTCW should be the same as for MTW with the added features of rapid reconfigurability, scalability, and deployability. The AEF hardware, software, and bandwidth environment should be the same as the home station so that we “fight the way we train.”

1. Plan, program, and budget for implementing coalition interoperability for joint, combined, and civil EAF operations.
2. Implement a user requirements-driven acquisition process with an emphasis on the controller and shooter.
3. Conduce a top-level requirements review for aircraft antennas for a unified and integrated approach.

DEVELOP A SPECTRUM OF TAILORED WEAPONS EFFECTS

Provide a capability for delivery of directed-energy effects to give the Air Force an OOTCW capability to disable or destroy electronic equipment (for example, computers and ignition systems) and other materiel as well as an antipersonnel capability, without producing blast effects or collateral physical damage.

Develop a family of air-deliverable directed-energy effects, including continuous wave and pulsed high-power microwave (HPM) devices and high energy lasers.

Accelerate development of compact high-efficiency aircraft electric prime power sources to

DEVELOP A SPECTRUM OF TAILORED WEAPONS EFFECTS (continued)

enable directed-energy applications. Specific initiatives include:
- Demonstrate an HPM "gun" integrated into airborne platforms
- Demonstrate air-delivered "mines" to halt or delay movement of enemy forces
- Accelerate development of compact high-efficiency aircraft prime power sources to enable directed energy applications
- Demonstrate HPM self-defense devices for aircraft

Develop anti-material agent technologies, weapons, and delivery methods.
1. Accelerate development of high-precision, air-deliverable non-lethal "munitions" from manned aircraft and UAVs.
2. Develop a family of supporting payload technologies incorporating aggressive, biodegradable agents such as:
   - Supercaustic foams
   - Conductive foams.
   - Embrittlement and depolymerization agents
   - POL contaminants
   - Superlubricants
3. Simultaneously develop key attendant elements (effectiveness models, planning tools, BDA (bomb damage assessment), ROE (rules of engagement), and countermeasures).

Develop methods for destroying or neutralizing chemical and biological agents in bunker storage.
1. Develop the intelligence capability to provide precise storage location in three dimensions—"the right room."
2. Develop the capability to deliver a weapon into the storage location; with
   (a) precision delivery of the survivable penetrating body, and
   (b) precision fuzing to function in the right place.
3. Conduct an R&D program on an intense heat source.

Exploit the potential of UAVs for delivery of lethal and non-lethal effects.
1. Develop a family of UAVs and UCAVs with standard payload modules for air delivery of lethal and non-lethal effects; including to:
   - Define and develop low-cost, modular UAV and UCAV platform systems
   - Develop a family of UCAV weapons for the deep precision attack of mobile targets
   - Define and develop HPM, laser, gun, dispenser, and jamming modules
   - Develop associated external systems for C4I and logistics support
2. Simultaneously develop key attendant elements (effectiveness models, planning tools, BDA, ROE, and countermeasures).
3. Continue development of the UAV and UCAV technology base

Accelerate development of air-deliverable lethal miniature munitions. Develop a family of miniature munitions and:
1. Accelerate initiation of LOCAAS (Low-Cost Autonomous Attack System) engineering and manufacturing development (EMD).
2. Accelerate initiation of the Small Smart Bomb EMD.

MAINTAIN READINESS AND PRESENCE WITHIN OPTEMPO CONSTRAINTS

Create a Distributed Mission Readiness System (DMRS) from the Distributed Mission Training (DMT) concept. A robust and flexible Air Force-wide DMRS integrating all force elements will help train AEF personnel and help them rehearse for full-spectrum global engagement (MTW and OOTCW).

1. Establish overall Air Force leadership for DMRS (AF/XO).
2. Implement the Capstone Requirements Document for DMT and develop it into the Air Force DMRS; including:
   (a) Air Force -wide plans, architecture, and roadmap (AF/XP and AF/XO);
   (b) Formal acquisition strategy and force management plan (SAF/AQ);
   (c) DMRS system program office to manage transition and integration (SAF/AQ)
3. Maintain priority of current DMT efforts to bridge to DMRS (SAF/AQ and AF/XO).
4. Address major DMRS technical issues (SAF/AQ), including:
   (a) Multilevel security/need-to-know, latency issues, and behavioral models; and
   (b) Leverage related efforts in other services, USACOM, DARPA, and outside agencies.

Improve airlift responsiveness to OOTCW situations while reducing OPTEMPO impacts. Institute the following process initiatives:

- Size the airlift force structure on the larger of OOTCW or MTW requirements (AF/XP)
- Reevaluate the active/ARC (Air Reserve Components) force mix; increase the active crew ratio (AF/XO)
- Examine alternative depot maintenance concepts for the KC-135 fleet (AF/IL)
- Procure the right mix of C-130Js, C-130s, and C-17s (AF/XP)

Institute the following capability initiatives:

- Upgrade the C-5 to the most cost-effective reliability (AF/XP)
- Install C-17 center wing tanks (SAF/AQ)
- Continue the C-130 Avionics Modernization Program (SAF/AQ)
- Pursue simulator alternatives to proficiency flight training (SAF/AQ)
- Accelerate the KC-135 multipoint, soft-basket refueling capability to free KC-10s (AF/XP)
- Procure the Next Generation Small Loader (SAF/AQ)